R E P O R T R E S U M E S

ED 019 397 08 VT 001 305

COMPARING THE EFFECTIVENESS OF TWO METHODS OF TEACHING AGRICULTURAL SCIENCE TO STUDENTS IN VOCATIONAL AGRICULTURE.

BY- WILLIAMS, TWYMAN G., JR.
VACAVILLE UNION HIGH SCHOOL DISTRICT, CALIF.

REPORT NUMBER BR-6-1407 PUB DATE AUG 67
GRANT OEG-4-6-061407-0638
EDRS PRICE MF-$0.25 HC-$0.68 15P.

DESCRIPTORS- *VOCATIONAL AGRICULTURE, *TEACHING METHODS, SCIENTIFIC PRINCIPLES, *LEARNING, *FEEDBACK, TIME FACTORS (LEARNING), RETENTION, *AUTOINSTRUCTIONAL METHODS, HIGH SCHOOLS, EXPERIMENTAL GROUPS, CONTROL GROUPS, COMPARATIVE ANALYSIS, EDUCATIONAL EXPERIMENTS, CALIFORNIA, EDEX COMMUNICATOR,

THE EFFECTIVENESS OF VISIBLE RECORDED FEEDBACK RESPONSES IN TEACHING SCIENTIFIC THEORY AND PRINCIPLES TO VOCATIONAL AGRICULTURE STUDENTS WAS STUDIED. SPECIFIC OBJECTIVES WERE TO DETERMINE THE VALUE OF GROUP FEEDBACK TO THE TEACHER, THE DIFFERENCE IN LEARNING RETENTION BETWEEN STUDENTS WITH AND WITHOUT FEEDBACK, AND THE DIFFERENCE IN EFFICIENT USE OF TEACHING TIME BETWEEN THE FEEDBACK AND TRADITIONAL METHODS. EXPERIMENTAL AND CONTROL GROUPS OF 140 STUDENTS IN FOUR CALIFORNIA SCHOOLS WERE TAUGHT TEACHER-DEVELOPED LESSONS IN ANIMAL PHYSIOLOGY AND PLANT CELLS, EACH FOR 1 WEEK. ONE SUBJECT WAS TAUGHT BY TRADITIONAL METHODS AND THE OTHER BY THE USE OF THE EDEX COMMUNICATOR WHICH CONSISTED OF INDIVIDUAL PUPIL RESPONSE UNITS AND A CONSOLE WHICH SHOWED INDIVIDUALS AND GROUP STUDENT RESPONSE TO EACH QUESTION. THE EXPERIMENTAL APPLICATIONS IN DIFFERENT SCHOOLS WERE STAGGERED TO UTILIZE EQUIPMENT. A PRETEST, POSTTEST, AND A TEST FOR RETENTION AFTER 3 MONTHS WERE GIVEN. DATA WERE SUBJECTED TO AN ANALYSIS OF CONVARIANCE. RESULTS SHOWED THAT IMMEDIATE FEEDBACK DID NOT IMPROVE STUDENT LEARNING MORE THAN THE TRADITIONAL METHOD, RETENTION WAS GREATER BY THE CONTROL GROUP, AND TEACHERS AND STUDENTS JUDGED THE FEEDBACK METER TO BE EFFICIENT IN TERMS OF TIME. (JM)

ED019397

FINAL REPORT
Project No. 6-1407
Grant No. OEG 4-6-061407-0638

COMPARING THE EFFECTIVENESS OF TWO METHODS OF TEACHING AGRICULTURAL SCIENCE TO STUDENTS IN VOCATIONAL AGRICULTURE

August 1967

U. S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

Office of Education
Bureau of Research

VT004128
VT001305

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

COMPARING THE EFFECTIVENESS OF TWO METHODS OF TEACHING AGRICULTURAL SCIENCE TO STUDENTS IN VOCATIONAL AGRICULTURE.

Project No. 6-1407
Grant No. OEG 4-6-061407-0638

Twyman G. Williams, Jr.

August 31, 1967

The research reported herein was performed pursuant to a grant with the Office of Education, U.S. Department of Health, Education, and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Office Education position or policy.

Vacaville Union High School District

Vacaville, California

TABLE OF CONTENTS

I.	Introduction	1
II.	Method	1
III.	Instruction Schedule - Table 1	3
IV.	Results - Tables 2 & 3	4
V.	Discussion	5
VI.	Conclusions, Implications, Recommendations	5
VII.	Summary	6

Appendix A - Summary of Statistics

Appendix B - Teachers' Subjective Evaluations

ACKNOWLEDGMENTS

I am very appreciative for the valuable assistance and encouragement given to me by Dr. Everette D. Eddington, State Director of the Research Coordinating Unit of the California State Department of Education; by Dr. Elwood M. Juergenson, Associate Professor, Department of Education, University of California; Dr. Kenneth Densley, Research Consultant, Research Coordinating Unit of the California Department of Education. These men served as my consultants for this study.

I am grateful to Professor Sidney S. Sutherland, Retired, former Chairman of the Department of Agriculture Education, University of California, for his permission to use his standardized test developed for evaluation of the manual, Biological Principles In Agriculture.

I am very appreciative for the valuable assistant and encouragement given to me by Dr. Warren S. Barham, geneticist at Basic Vegetable Products, Inc., and former president of the Board of Education of the Vacaville Union High School District; by Mr. Fred L. Petersen, former District Superintendent of the Vacavill Union High School District and present Associate Superintendent of the Vacaville Unified School District; and by Mrs. Doris Smith, secretary to Mr. Petersen; and by Mr. Lyle Welch, principal of Vacaville High School.

Grateful acknowledgment is given to: Larry Rathbun, Darryl V. Mortensen, and James Ignatieff, teachers of Vocational Agriculture at Rio Vista, Dixon, and Fairfield, California, whose particpation and cooperation made this study possible on a county-wide basis; and to James Bennett, graduate student at University of California at Davis, the statistician who worked with me on this project.

I. Introduction

Vocational Agriculture Science or Agriculture Science is a complex composite science course. For this reason, it is desirable to find ways in which maximum learning can be achieved with the most efficient use of teacher-time. Close examination of the Edex Communicator with its system of feed-back caused me to form the hypotheses expressed as objectives of this investigation. Therefore, this study was made to determine the effectiveness of visible recorded feed-back responses in the teaching of scientific theory and principles to students of vocational agriculture. "Feed-back" is the response of students to the instructor.

A. Objectives

1. To determine the value of using immediate group feed-back to the teacher when teaching vocational students on the early secondary level

2. To determine if there is a difference in retention of learning between students in vocational agriculture when taught with and without the feed-back machine

3. To determine if feed-back meters make more efficient use of teaching time.

II. Method

The equipment used in this test was the Edex Communicator. The Communicator consisted of the main console, which the instructor uses, and the individual response units placed on the desk of each student. The main console has the following features: (1) A group of lights on the Deck indicates the participation and response of each student to a particular question; (2) Four meters marked A, B. C, and D on the console indicate the percentage distribution of the class in relation to the four possible answers. For example, 80% might answer A, 6% B, 11% C, and 3% D; (3) An accumulator which will keep the total score of each student for the day. It was anticipated that through the use of this equipment the teacher would be able to adjust his teaching presentation and methods according to class response and comprehension.

The project was carried out in four high schools in Solano County, California. The four schools were selected at random for teaching two units, Animal Physiology and Plant Cells, experimentally and as a control. The four Agricultural Science teachers from each school developed the lesson plans for the project. The four units that were taught covered fundamental principles of animal physiology, poultry production, plant cells, and production of barley. Scheduling of the Communicator and the lesson plans into the four high schools followed the development of the lesson plans. Table 1 is the scheduling plan used in the project. A staggered plan was used since only one Communicator was available.

The actual experiment used two (Animal Physiology and Plant Cells) of the four lesson plans. The other two units were used in reducing the Hawthorne effect. The students were told they were involved in a project but were not told which one of the four units was control or experimental. The two units that were included in the experiment were taught in the pattern as outlined on Table 1. As indicated on Table 1, two schools taught the Plant Cells unit for one week using the traditional method of instruction (control) followed by the unit on Animal Physiology (experimental) which was taught using the Communicator. The other two schools used the same units but reversed their roles. Plant Cells unit (experimental) was taught using the Communicator and the Animal Physiology unit (control) was taught traditionally. Immediately following the instruction of each unit a test was given. The standardized test was given after the four units for measuring achievement gain. A test for retention was given three months later.

A standardized test for students in Vocational Agriculture (developed by Professor S. S. Sutherland, Agricultural Education Department, University of California at Davis) was the instrument used for the Pre-test before the units were taught. The Pre-test indicated the general achievement of each student in Agriculture Science, and was used as an adjustment factor when evaluating student performance in the experiment. (By using these scores as control variables in the analysis of covariance, the possible bias introduced by individual differences is removed since these factors adequately represent the differences in question.)

III. Instruction Schedule

TABLE 1

Date	High School			
	RIO VISTA	ARMIJO	VACAVILLE	DIXON
Sept 19	Standardized Pre-test			
Sept. 26	Control Animal Phys.			
Oct. 3	Familiari-zation-Poultry			
Oct. 10	Experimental* Plant Cells	Standardized Pre-test		
Oct. 17	Barley	Control Plant Cells		
Oct. 24	Standardized Post-test	Familiari-zation-Barley		
Oct. 31		Experimental Animal Phys.	Standardized Pre-test	
Nov. 7		Poultry	Control Animal Phys.	
Nov. 14		Standardized Post-test	Familiari-zation-Barley	
Nov. 28			Experimental Plant Cells	
Dec. 5			Poultry	
Dec. 12			Standardized Post-test	
Jan. 2				Standardized Pre-test
Jan. 9				Control Plant Cells
Jan. 16				Familiari-zation-Poultry
Jan. 23				Experimental Animal Phys.
Jan. 30				Barley
Feb. 6				Standardized Post-test
Retention Tests	Jan. 16	Feb. 6	Feb. 27	May 1

*Experimental means that the unit was taught with the Communicator

IV. Results

The following table shows the results from the tests given immediately after the units were taught.

TABLE 2

Conditions of the Experiment	Number of Students Taught	Plant Cells and Animal Physiology Scores from all Four Schools		Score on the Standardized Pre-test	
		$\leq Y$	$\overline{Y}$	$\leq X$	$\overline{X}$
Experimental	71	2072	29.2	1518	21.4
Control	69	2247	32.5	1463	21.2

The following table shows the results from the tests given 3 months after the units were taught.

TABLE 3

Conditions of the Experiment	Number of Students Taught	Plant Cells and Animal Physiology Retention Scores From all Four Scores		Score on the Standardized Pre-test	
		$\leq Y$	$\overline{Y}$	$\leq X$	$\overline{X}$
Experimental	70	1769	25.3	1521	21.7
Control	69	2044	29.6	1481	21.5

V. Discussion

Analysis of Table 2 shows a difference of 3.3 points between the mean scores on the Animal Physiology and Plant Cells tests favoring the control group, while there is a small difference of only .2 point between groups on the standardized test. Results from the statistical analysis provide a value which is not significant.

The results from Table 3 show a difference of 4.3 points between the mean scores on the Animal Physiology and Plant Cells tests favoring the control. There is a .2 point difference between the groups on the standardized test. These results from the statistical analysis provide a value which is significant. ($P = .05$)

VI. Conclusions, Implications, and Recommendations

Under the conditions of this experiment the statistics indicate the following results: (1) Immediate group feed-back did not improve student learning when compared to the traditional method; (2) Retention of learning in the control group was significantly greater ($P = .05$) than those in the experimental group. These findings were based upon the statistical method called the analysis of covariance; (3) The efficiency of teaching time by using the feed-back meters was subjectively evaluated by each of the four participating teachers. All agreed that this feature is a positive asset in determining student comprehension and in pacing the presentation of the lesson. Each teacher likes not only this feature, but the entire machine and would use it if available. Students like it especially, since they know their test results in minutes after taking the test.

The results of the investigation and the analysis of this study by the instructors and consultants have brought forth some interesting ideas which could be the basis for further research. One area of interest is the differences that exist between a large and a small class. The use of a Communicator in a large class has been proven to be effective. The feed-back from a small class may not require an electronic device, such as the Communicator, since the teacher, in this situation, can usually determine his effectiveness fairly accurately and with little loss of time. Further research would be of great help in determining the effectiveness of this type of equipment with small classes. Perhaps also further research should extend for a longer period--two or three weeks on a unit, rather than one week. Perhaps a population of several hundred or one thousand would yield better data for analysis.

VII. Summary

This project was concerned with the effectiveness of feed-back on teaching time and on student learning in classes being taught agricultural principles.

The results of the investigation showed no significant difference in learning between those students using feed-back equipment and those who were taught under traditional methods. There was an indication that those receiving traditional methods of instruction had a higher retention of the material taught than those who used the feed-back equipment.

The feed-back equipment used consisted of individual student response units and a master console which recorded the responses made by the students. A program was developed by four Agriculture Science teachers which consisted of four units (Animal Physiology, Plant Cells, Barley, and Poultry). Each unit required one week of instruction and was immediately followed by a test on the material. Two of the units (Animal Physiology and Plant Cells) were used in the experiment and were scheduled into four (numbered 1, 2, 3, 4) different high schools. The Animal Physiology was taught in No. 1 and No. 2 high schools using feed-back equipment. The Plant Cells unit was taught in No. 1 and No. 2 under traditional methods. (control). The No. 3 and No. 4 high schools received the same units except their roles were reversed, i. e., Animal Physiology unit was control and the Plant Cells unit was experimental. The Barley and Poultry units were used to familiarize the students with the equipment and to reduce the Hawthorne Effect. Because of initial student differences in achievement, a standardized pre-test in Agriculture Science was given and used in the statistical analysis.

The efficiency of teaching time by using the feed-back meters was subjectively evaluated by each of the four participating teachers. All agreed that this feature is a positive asset in determining student comprehension and in pacing the presentation of the lesson. Each teacher likes not only this feature, but the entire machine and would use it if available. Students like it especially, since they know their test results in minutes after taking the test.

It is recommended that further research be done to see if the equipment has an effect on small classes or very large classes receiving vocational instruction.

APPENDIX A

I. SUMMARY OF STATISTICS

A. Statistics from the test given immediately after instruction

Source of Variation	df	SSx	SSy	SSxy	Syx	MSyx(Vxy)
Among	1	2750	400	-22	446	446
Within	137	24329	14540	3128	14138	103
Total	138	27079	14940	3106	14584	

$$Fyx = \frac{446}{103}$$

$$= 4.33$$

F at .05 level = 3.91
F at .01 level = 6.83

SDyx = 10.15

SE_D between any two adjusted means = 2.41

For 137 df t.05 = 1.98
t.01 = 2.62

.05 = 1.98 x 2.41 = 4.77
.01 = 2.62 x 2.41 = 6.31

	Adjusted Means
Experimental	25.3
Control	29.6
	4.3

B. Statistics from the test to measure retention

Source of Variation	df	SSx	SSy	SSxy	Syx	MSyx(Vxy)
Among	1	3	657	- 39	662	662
Within	136	6757	9698	3608	9506	69.89
Total	137	6759	10356	3568	10168	

$$Fyx = \frac{662}{70} = \underline{9.47}$$

F at the .05 level = 3.91
F at the .01 level = 6.82

SDyx = 8.36

SE_D between any two adjusted means = 2.00

For 136 df t.05 = 1.98
t..01 = 2.62

.05 = 2.00 x 1.98 = 3.96
.01 = 2.00 x 2.62 = 5.24

	Adjusted Means
Experimental	25.3
Control	29.6
	4.3

APPENDIX B

I. Feed-back Research--Teachers' Subjective Evaluations

A. The use of the Communicator has proven to me the value of mechanical feed-back machines in teaching Vocational Agriculture Science. If nothing else, the increased interest of students created by the Communicator would more than offset any of its disadvantages.

I believe the advantages of the Communicator are as follows:

1. Helps create student interest
2. Involves all students in lesson
3. Long-term lesson plan time is reduced
4. Lets teacher know immediately progress of each student--immediate feed-back
5. Gives teacher each student's point scores daily.

Points needing improvement:

1. Lesson planning time--initial lesson preparation time is great
2. Classroom arrangements--special classroom arrangements must be made, such as plugs in floor or external conduits, which make it difficult to adapt to old classroom
3. Student needs--student needs the ability to read
4. Simultaneous activity--many things are going on at the same time--overlays; slides; keeping scores; question sheets must be completely organized--all requires lots of teacher preparation.

Darryl V. Mortensen, Chairman
Agriculture Department
Dixon High School
Dixon, California

B. Reaction:

This machine was found to be valuable as a teaching aid if in a permanently installed installation.

The most value of this was the immediate response to questions. The use of accompanying teaching aids seemed to enhance instruction. This operator found the carrousel projector of great value in interest stimulation.

The students seemed anxious the first week and progressed rapidly. With the effect of "something new" worn off, the

second week an increased mis-use was detected. Some students would wait to hear the "click" of the response meter before answering. By having students answer on second reading of responses this was overcome. Many students "fumbled" with the keys as the lesson progressed.

It is believed that the machine could become a useful aid if it could be tested for a semester of a full year. Student would then realize the value of the immediate response.

Student keys could have been hidden more, as a number of students watched the response of others.

As a value to an instructor, the machine was found most valuable in taking roll and determining percent correct responses. This was of value in controlling the speed of the class through the lesson.

The evaluation of the response scores can best be evaluated by the author and his statistician.

James M. Ignatieff, Teacher
Vocational Agriculture Department
Armijo High School
Fairfield, California

C. The use of the Communicator has a very definite place in the instruction of Vo-Ag Science, excepting the initial cost of equipment.

I believe the advantages of the system are:

1. More effective teacher-student discussion
2. Greater motivation to the average student
3. Teacher benefits from knowing exactly what class is thinking during the period
4. Immediate feed-back of results of questions
5. Better instruction as a result of more time spent on lesson preparation.

It would appear as though the following may be possible disadvantages:

1. Instruction is largely teacher centered
2. Some students may have a greater chance to cheat due to technique of asking questions

3. Cost per student is quite high
4. Teaching by asking questions may not be the best method all of the time.

Larry Rathbun
Director of Agriculture
Rio Vista Joint Union High School
Rio Vista, California

D. It is my firm opinion that the use of the Communicator teaching machine is considerably more valuable in teaching, learning and retention than this brief study indicates.

Students liked this machine and asked to use it more, after they had used it three weeks. I also like it and would use it if our school district owned one.

Its strongest points, in my opinion, are:

1. Immediate feed-back to both students and teacher
2. Motivation of student interest
3. Its efficiency in grading (objective type) student class-work and tests
4. High quality of prepared instructional material is required.

Other significant points are:

1. Considerably more teacher time is required in preparation of units to be taught with this machine. However, if these units are confined to sound principles, the time is efficiently used.
2. Unless all answers to a question are presented on the same frame or projection, cheating is easily possible
3. This is simply a method of teaching and should be used in rotation with other methods of teaching for maximum effectiveness
4. Although this equipment is portable, it would be better to have the response units permanently installed and leave the console portable. Too much time is required to set up and put up the response units for moving to different rooms for consecutive periods.

Twyman G. Williams, Jr.
Chairman
Agriculture Department
Vacaville High School
Vacaville, California